Technical Attachment

Improving Extended Period Verification

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Introduction

Since the advent of public zone forecasts that go out a full seven days, forecasters have debated the amount of forecast skill that is achieved in a seven day forecast. At WFO Amarillo a concerted effort began in July 2002 to verify the temperature forecasts for the extended periods. Along with verifying the entire seven day forecast, an investigation was undertaken to determine possible trends in the model guidance.

Methodology

On July 15, 2002, WFO Amarillo began issuing a seven-day Coded Cities Forecast (CCF) for the city of Amarillo. Since that date, in addition to local and national verification efforts for days one and two, the WFO has verified temperature forecasts through day seven for the city of Amarillo. The forecasts are compared against observed maximum and minimum temperatures, climatological normals, and model output statistics (MOS) from the 0000 UTC run of the Global Forecast System (GFS), forecast product MEXAMA (MEX).

Data are collected once a day at approximately 2100 UTC. Although the WFO forecasters produce two CCF products each day around 0800 UTC and 2000 UTC, only the afternoon CCF was used in this study. The afternoon product was used because the model based guidance (MEX) is produced only once a day. In order to keep a true comparison with MOS guidance only one forecast per day was compared.

Results

Figure 1 depicts the WFO Amarillo percent improvement over MEX during the Day 3 through Day 7 forecast periods between July 15 and October 7, 2002. Except for the Day 3 low temperature forecast, MEX showed a significant improvement over the local forecast in all periods. For example, the Day 7 MEX minimum temperature forecast improved over the local forecast by more than 20%.

These results from a first look at objectively comparing extended range forecasts were presented at a WFO staff meeting in early October 2002. Since that time data collection has continued and post-staff meeting verification scores have been computed. Since the staff meeting a significant improvement in the local verification scores has occurred. Figure 2 compares local and guidance forecasts for the period before (July 15 - October 6) and after the staff meeting (October 7, 2002 - October 7, 2003).

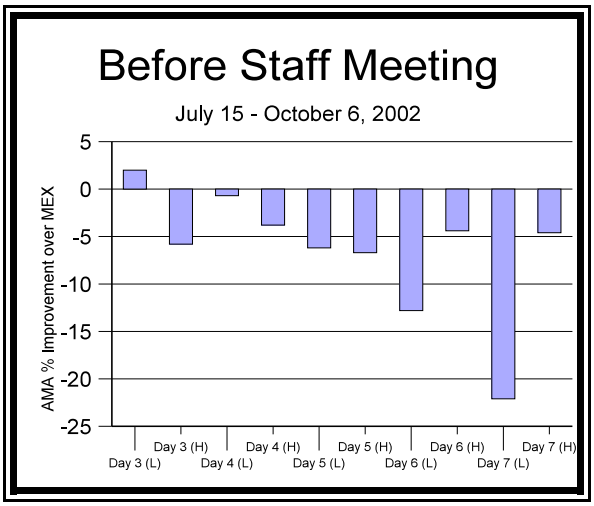

Figure 1. Percent improvement of WFO forecasts over MEX guidance for period indicated.

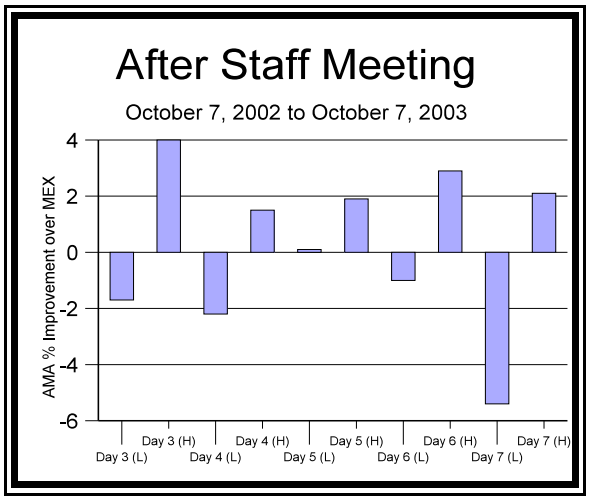

Figure 2. Same as Fig. 1, but for period indicated.

The percent improvement over guidance since the staff meeting shows an interesting trend. Forecasters now improve over the MEX maximum temperature forecasts in all periods, but MEX low temperature forecasts continue to show an improvement over the local forecasts in almost all periods, although significantly less so than prior to the staff meeting. The Day 7 MEX minimum temperature forecast now has only a 5% advantage over the local forecast.

Another approach taken was to determine any trends with the MEX forecasts against observed temperatures (Amarillo ASOS observations). Figure 3 depicts the MEX MOS average bias for the period November 1, 2002 to January 17, 2003. Low temperature guidance forecasts showed a slight warm bias and erred no more than 1.15 deg. High temperature forecasts, on the other hand, indicated a cool bias between 1 and 2 deg. During the same period the MEX MOS demonstrated significant variability. Figure 4 shows standard deviation of the MEX guidance compared to observed temperatures.

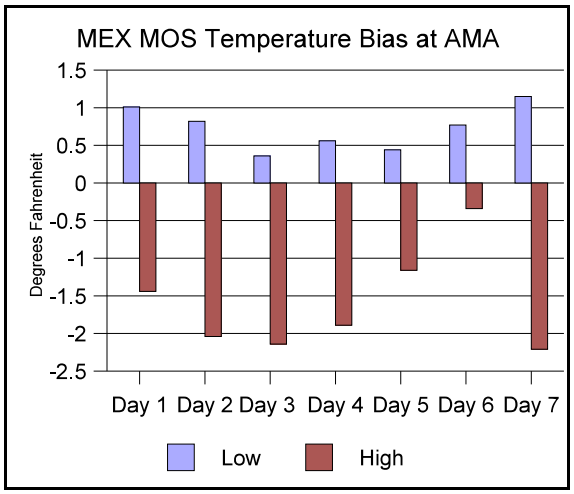

Figure 3. MEX MOS average bias at Amarillo, November 1, 2002 to January 17, 2003.

The minimum temperature forecasts varied from the observed values by 4.38 deg on Day 3, to as much as 5.58 deg on Day 7. Maximum temperature forecasts differed by nearly 7 deg on Day 3, to slightly more than 9 deg on Day 7. These results indicate the GFS model forecasts can be improved upon during the extended periods with attention from the local office.

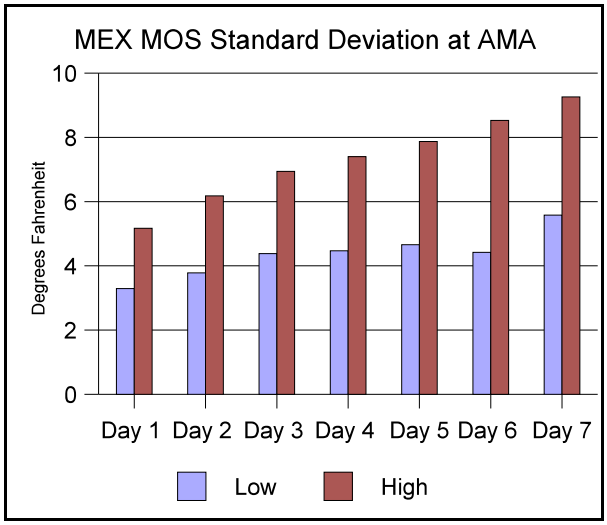

Figure 4. Same as Fig. 3, but Standard deviation.

Conclusions and Future Work

Efforts are underway to see what trends, if any, can be found from run-to-run differences in the medium range models, especially the GFS. Attempts are also being made to find trends in MEX MOS biases that may be related to synoptic pattern and season. Another step is to determine any trends within the daily MEX guidance and develop sound meteorological reasoning for adjusting model guidance. With the implementation of IFPS (Interactive Forecast and Preparation System) and a team effort to make the forecast grids as meteorologically sound as possible, local skill and knowledge provide the basis for enhanced forecasts. Forecast collaboration between offices should improve as a result of finding and sharing these trends.

WFO Amarillo extended forecasts improved by approximately 12% overall just by monitoring verification scores. The improvements occurred with minimal effort, over a short period of time, thanks to a concerted effort to verify extended period forecasts. Another reason for the improvement is a dedicated effort to improve understanding of when and why extended forecasts did well, or did not do well. As a result of these efforts, we have improved the quality of seven- day forecast grids which our customers demand.